GIARDIA INTESTINALIS

Guidelines for Prevention and Control
for
Local Public Health Agencies

July, 2001

Communicable Disease Epidemiology Section
Bureau of Public Health
Division of Public Health, Department of Health and Family Services

Cover Image: *Giardia intestinalis* trophozoites as they appear under a scanning electron microscope. Original image by Arturo Gonzalez, CINVESTAV, Mexico

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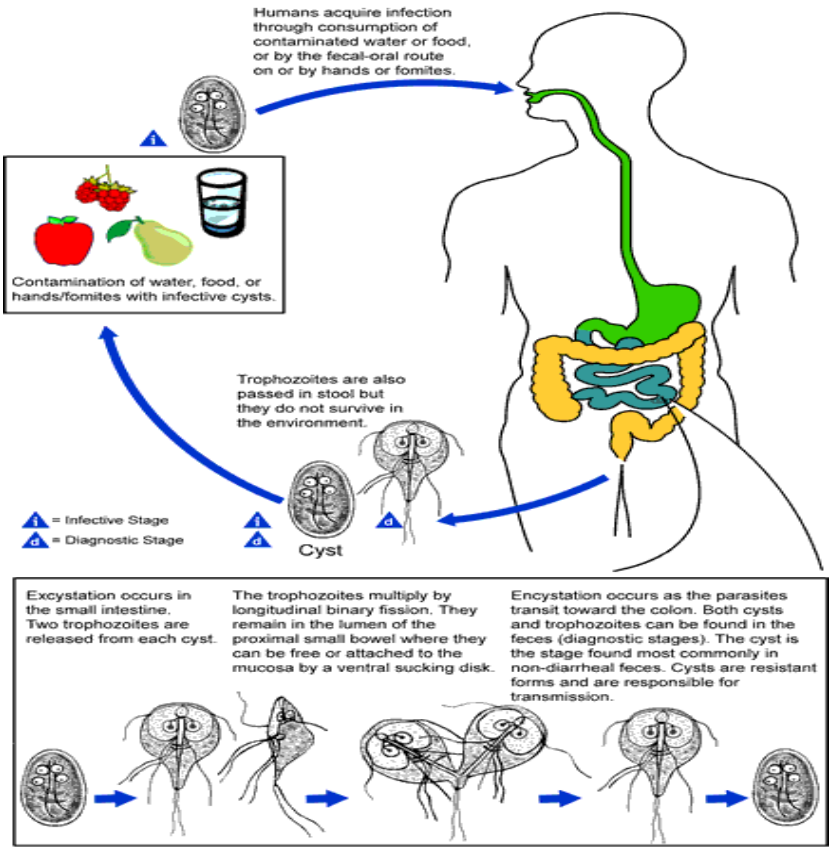
I. BACKGROUND

A. The Life Cycle of *Giardia intestinalis*

Giardia intestinalis is a protozoan found in both trophozoite and cyst stages. The pear-shaped, flagellated trophozoite inhabits the epithelial brush border of the upper two-thirds of the small intestine, where it absorbs nutrients from the intestinal tract and reproduces by binary fission approximately every five hours (1). Varying numbers of trophozoites detach from the intestinal mucosa and enter the fecal stream where they assume a round shape, secrete a wall, and enter the infective cyst stage that is excreted with the feces (see Figure 1).

As cysts, *Giardia* survives passage outside the host, and a new host acquires infection by ingesting cysts. After ingestion by a new host, the cyst reverts back to the trophozoite stage in the small intestine (excystation). Diarrheal stools may contain trophozoites due to rapid intestinal transit that may not allow sufficient time for cysts to form. The excreted trophozoites will disintegrate since the transformation to the infective cyst stage does not occur outside the host. Thus, transmission of infection directly from person-to-person or indirectly from water/food-to-person occurs with the *Giardia* cyst rather than the trophozoite stage.

Figure 1. The life cycle of *Giardia intestinalis*



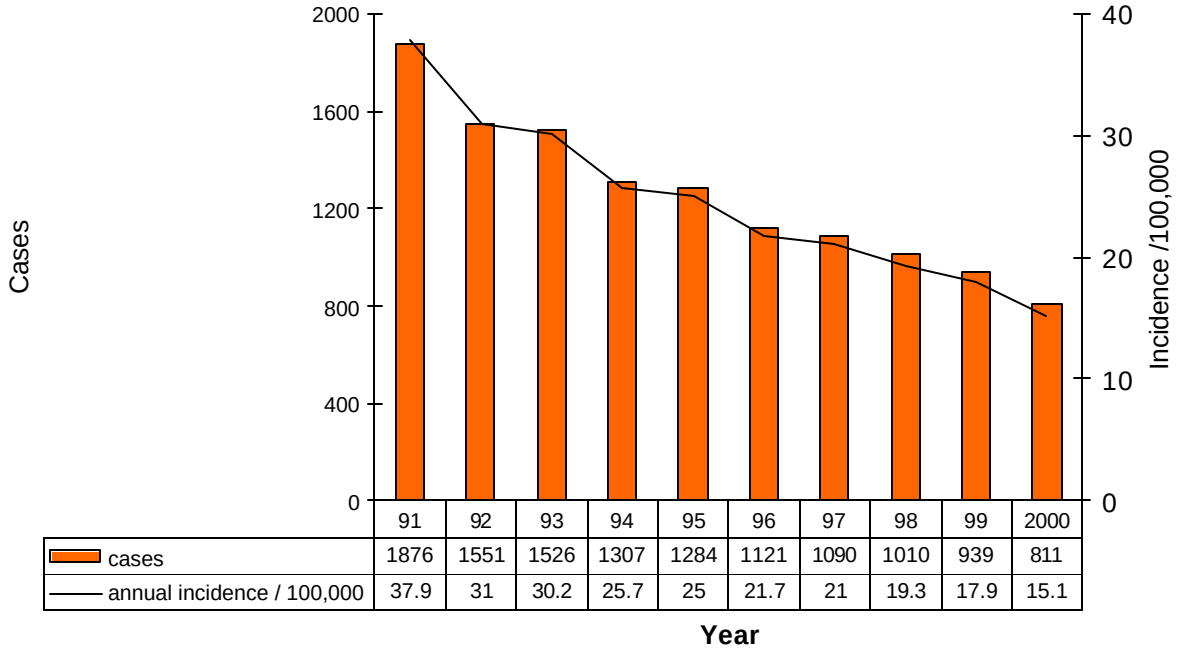
Centers for Disease Control and Prevention

II. GIARDIASIS IN WISCONSIN

A. The Incidence of Giardiasis in Wisconsin.

Following a steady increase in the number of reported cases of giardiasis in Wisconsin during the 1980's, a steady decrease in the number of reported cases was identified from 1991-2000 (Figure 2). The increase in case reporting during the 1980's was, in part, attributed to an increased awareness of the infections by the medical community, as well as a true increase in cases of human giardiasis. Since 1991 the decline in the number of reported cases might be attributed to decreased testing for the parasite, a true decrease in the incidence of giardiasis, or both. Despite the decrease in reported cases, continued education and updates of current recommendations provided to health care professionals and the public are needed to assure the decline in reported cases continues.

Figure 2. Reported cases and annual incidence of giardiasis (infections per 100,000 population) in Wisconsin. 1991-2000.



	91	92	93	94	95	96	97	98	99	2000
cases	1876	1551	1526	1307	1284	1121	1090	1010	939	811
annual incidence / 100,000	37.9	31	30.2	25.7	25	21.7	21	19.3	17.9	15.1

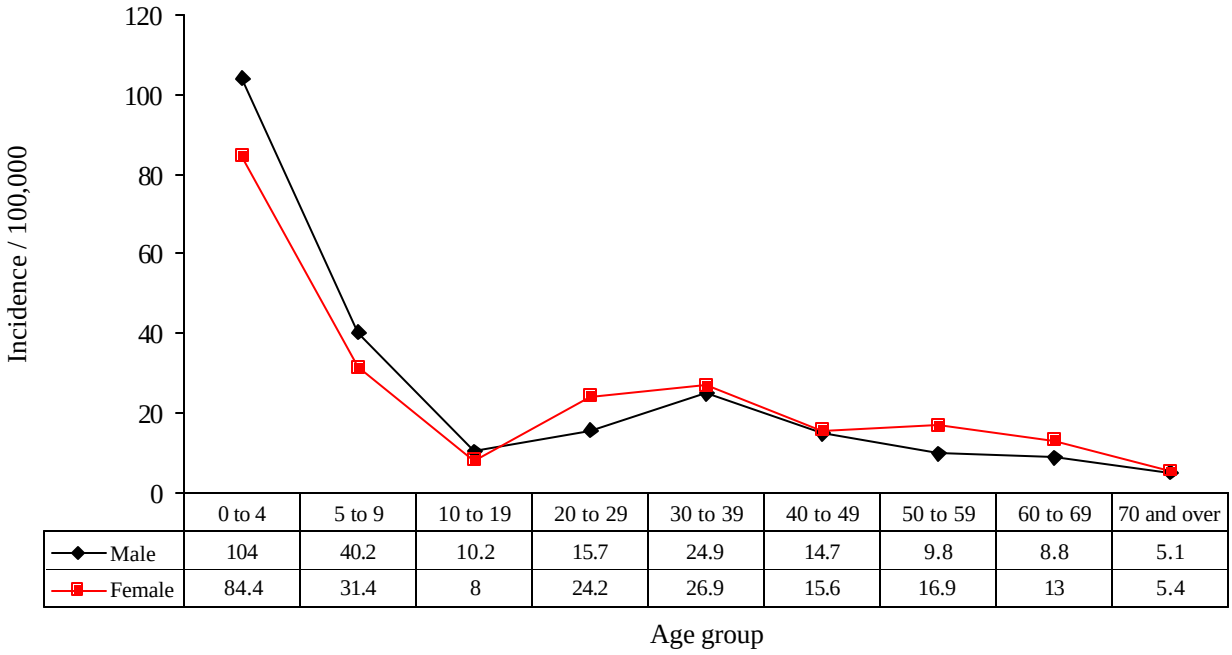
Note 1. Since 1991, The incidence rate and number of reported cases of giardiasis in Wisconsin has declined.

B. The Incidence of Giardiasis by Age and Gender

During the years 1991-2000, 51% of reported laboratory-confirmed cases of giardiasis were females. The infection rate for females (22.1/100,000) was not significantly different than that of males (22.4/100,000). The infection rate was higher for males compared to females up to age 20 after which a higher rate was noted in females.

In Wisconsin, the incidence rate of giardiasis was highest among children from < 5 years old (94.4/100,000). The high rate of reported infections in this age group is likely attributed to attendance in day care centers. An increase in incidence was noted among women in the 20 to 39 age group, likely due to exposure and increased care giving to younger children among women in this age group (Figure 3).

Figure 3. The incidence of giardiasis / 100,000 age-specific population, Wisconsin, 1991-2000.



	0 to 4	5 to 9	10 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 69	70 and over
Male	104	40.2	10.2	15.7	24.9	14.7	9.8	8.8	5.1
Female	84.4	31.4	8	24.2	26.9	15.6	16.9	13	5.4

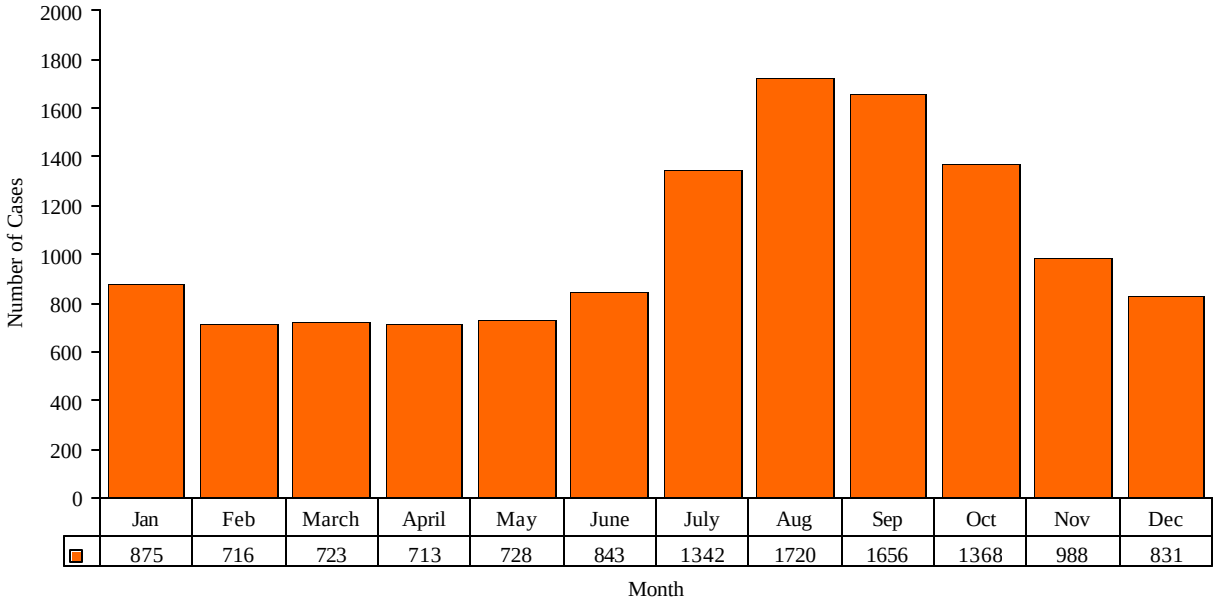
Age group

Note 2. Children < 5 years old have the highest incidence of giardiasis in Wisconsin.

C. The Seasonality of Giardiasis in Wisconsin.

Laboratory-confirmed cases of giardiasis occur throughout the year. The number of cases begins to increase in June and peaks in late summer and early autumn with the highest number of cases being reported in August (Figure 4). The seasonal peak in cases coincides with summer recreation season and may reflect increased recreational water use, especially by children (2).

Figure 4. Reported cases of giardiasis, by month, Wisconsin, 1991-2000.

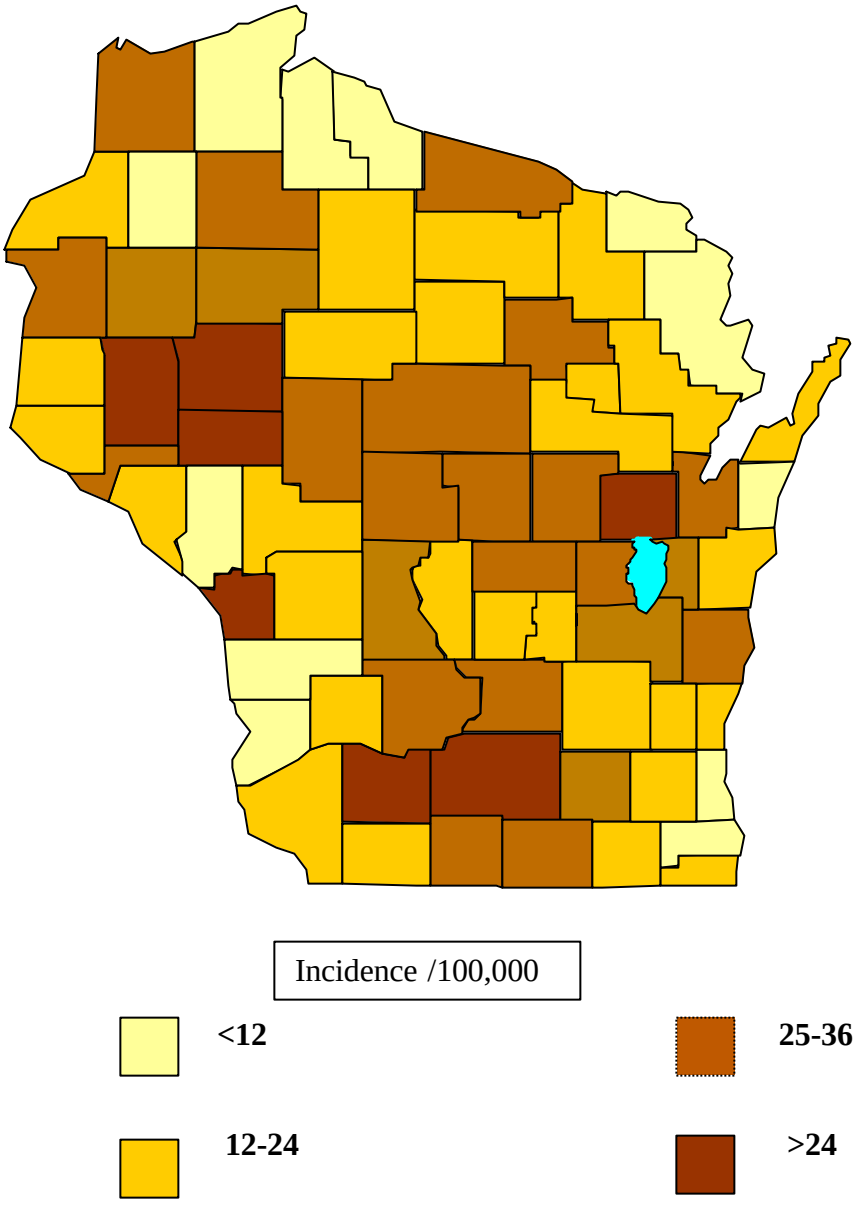


Note 3. The incidence of giardiasis peaks in late summer/early autumn in Wisconsin.

E. The Incidence of Giardiasis in Wisconsin by County.

Thirty-two of the seventy-two (44%) counties in Wisconsin exceeded the 10-year incidence rate of 23.5/100,000 total population. Of the 32 counties, seven (Dunn, Iowa, Dane, La Crosse, Chippewa, Eau Claire and Outagamie) exceeded the incidence rate by >50% (Figure 5).

Figure 5. The annual incidence of giardiasis by county /100,000 total population, Wisconsin, 1991-2000.



III. CLINICAL DISEASE

Clinical studies have shown that as few as ten cysts can infect humans; however two-thirds of those persons infected remain asymptomatic (2,3). When symptoms do occur, the onset usually follows an incubation period of 3 to 25 days or longer (usually 7-10 days). Without treatment, *Giardia* cysts can be excreted in the stool for weeks or months. Clinical giardiasis varies greatly in severity and duration and tends to be most severe and prolonged in persons with an altered immune system. Children and persons with prior giardiasis are most likely to have asymptomatic giardiasis (2). Acute and chronic clinical spectrums are seen following infection with giardiasis.

1. Acute giardiasis is characterized by the sudden onset of acute, watery diarrhea usually not containing blood or pus. Other symptoms may include abundant intestinal gas producing abdominal distension and flatulence, fatty stools, abdominal cramps, anorexia, nausea, vomiting, weight loss, and weakness. Acute giardiasis generally resolves in 1 to 4 weeks, but may persist for months in children, leading to malabsorption and malnutrition (4).

2. Chronic giardiasis is generally milder and may or may not have been preceded by an acute episode. It is manifested by intermittent or periodic episodes of diarrhea with mushy, foul-smelling stools, increased flatulence, and heartburn and weight loss that persist for weeks or months. Children infected with *Giardia* who do not have diarrhea should be observed for evidence of malabsorption, impaired growth or failure to thrive, and otitis media with a history of repeated antibiotic treatment failures.

Note 4. Children and persons with prior episodes are most likely to have asymptomatic giardiasis
Note 5. Two distinct clinical spectrums of giardiasis are seen among infected individuals.

IV. THE EPIDEMIOLOGY AND PREVENTION OF GIARDIASIS

A. Modes of Transmission

The transmission of *Giardia* to humans is dependent upon the ingestion of cysts excreted in the feces of infected persons or animals. The principal mode of transmission to humans appears to be person-to person, although indirect transmission from contaminated water and food, originating from humans and animals has been described.

1. Person-to-person transmission occurs by hand-to-mouth transfer of cysts from the feces of a person infected with *Giardia* (symptomatic or asymptomatic). Outbreaks of giardiasis in day care centers, especially those with diapered children, have been associated with fecal-oral transmission of *Giardia* (3,5-14). Sexual transmission of giardiasis (oral-anal) has been recognized, principally among men who have sex with men (15).

2. Untreated surface water is a recognized vehicle of *Giardia* transmission (16,17). Campers and hikers have been infected by drinking untreated stream water, probably contaminated by infected animals or septic sewage. Emergency water supplies are best boiled following filtration. Less effective is treatment with hypochlorite solution (0.1 to 0.2 ml/liter) or tincture of iodine (0.5 ml/liter of 2% solution) for 20 minutes or longer if the water is cold or turbid (18).

3. Municipal water, contaminated with raw or inadequately treated sewage has been linked to outbreaks of giardiasis (17). Chlorination alone may not kill *Giardia* cysts; sedimentation filtration of untreated water may be necessary to kill cysts. The testing of municipal water supplies for *Giardia* should only be considered in the situation of a large community-wide outbreak where initial testing for coliform organisms suggests contamination or a break in the system. Concentrations of chlorine used in routine drinking water treatment do not kill *Giardia* cysts (18,19,20).

4. Well water is an unlikely source for *Giardia* unless surface water contamination of the well can be demonstrated. Laboratory testing for *Giardia,* although rarely done and very expensive, requires filtering large quantities of water using special techniques. Suspected well contamination by surface water can be determined by testing for coliform organisms.
5. Foodborne transmission from infected food workers has been documented (21-24). Although *Giardia* does not reproduce in food, the small infective dose ($\leq$ 10 cysts) suggests that it could be easily transmitted by fecal contaminated food. Handwashing, washing raw vegetables and using gloves in the preparation of raw vegetables and cold foods are essential to prevent foodborne transmission of *Giardia*.

6. Animal sources of *Giardia* are common. Except for *G. intestinalis,* the ability of *Giardia* species found in non-human sources to cause human illness is unclear. *G. intestinalis* are commonly found in domestic animals such as dogs and cats, and a variety of wild animals. Infected beavers have been implicated in waterborne outbreaks of giardiasis.

Note 6. Concentrations of chlorine used in routine drinking water treatment methods do not kill Giardia cysts.

B. Risk Factors for Acquiring Giardiasis

Extensive studies in Washington (state), Denver, Colorado, and the United Kingdom (5,25,26,27) have identified risk factors for acquiring giardiasis among adults and children (see Table 1).

Table 1. Risk factors of adults and children for acquiring giardiasis.

Adults
▪ having young children, especially children who attend nursery school or day care
▪ foreign travel, particularly to underdeveloped countries
▪ travel i.e. camping, hiking
▪ consumption of untreated surface water
Children
▪ attending a day care center, especially 20 hours a week or more for six months or longer
▪ having young siblings, especially those who attend nursery school or day care centers

C. Prevention of Giardiasis

1. Recognition of risk factors -Hikers and campers should avoid drinking water directly from streams or lakes. Filtration followed by boiling or treatment of raw water with iodine or hypochlorite solution will kill *Giardia* cysts (16,17,18). Travelers to foreign countries, especially to underdeveloped countries where sanitation is not optimal should be informed of the increased risk of acquiring giardiasis. Parents of children who attend day care should be informed by day care staff of potential exposures of their children to *Giardia*. Parents and day care staff should be aware of the need to exclude children with diarrhea from day care, to seek medical diagnosis and treatment.

2. Personal hygiene - Handwashing is the most effective measure to prevent transmission of giardiasis. Thorough handwashing after toileting and handling items contaminated with feces will help prevent the spread of *Giardia* in the home and in day care centers.

3. Case finding and treatment - Because person-to-person spread of *Giardia* is very common in families, nurseries, and day care center settings, transmission of disease may be prevented by identifying symptomatic contacts of infected persons. Because no medication is 100 percent effective, follow-up of treated individuals may be important, especially in day care centers where large numbers of susceptible children are present.

Note 7. Day care attendees and those who ingest untreated water are at high risk of acquiring giardiasis.
Note 8. Handwashing is the most effective measure to prevent transmission of giardiasis.

V. DIAGNOSIS OF GIARDIASIS

A. Laboratory Diagnosis

The diagnosis of giardiasis can be accomplished by several methods:

1. The most common diagnostic procedure is direct microscopic examination of stool specimens for cysts and trophozoites, using direct mounts or concentration procedures.

2. Direct Fluorescent Antigen (DFA) test of stool specimens.

3. In outbreak situations when up to 10 stool specimens will be tested, the Wisconsin State Laboratory of Hygiene can order special kits to do an enzyme immunoassay (EIA) test.

4. Future tests to identify giardiasis may include reverse transcription-polymerase chain reaction (RT-PCR)

B. Stool Specimen Collection (2,29)

1. A walnut-sized portion of stool should be collected in a container with 10% formalin solution (Kit #3 from State Laboratory of Hygiene).

2. Although 85% of giardiasis can be diagnosed with a single stool specimen, cyst passage in stool is irregular. To assure a reliable diagnosis, consider collecting up to three stool specimens from symptomatic persons, on consecutive days or every other day for five days (2,30,31).

3. If possible, specimen collection should be delayed for one week following administration of barium, bismuth, anti parasitic drug therapy, magnesium or laxatives.

4. Due to the high rate of asymptomatic *Giardia* infection, individuals with diarrhea of unknown etiology should also be tested for *Cryptosporidium* and enteric pathogens *(Salmonella, Shigella, E.coli* O157:H7*, and Campylobacter*). Stool to be tested for *Cryptosporidium* should be collected by the same method used for *Giardia.* Stool tested for enteric pathogens should be collected in a vial containing Cary-Blair medium .

Following effective drug therapy, *Giardia* cysts may be detected in stool for 1-2 days by direct examination, or 3-4 days by DFA testing (David Addiss, CDC, personal communication).

Note 9. To assure a reliable diagnosis, consider collecting up to three specimens from symptomatic persons, on consecutive days or every other day for five days.

VI. TREATMENT OF GIARDIASIS

A. Treatment of symptomatic cases of giardiasis

Symptomatic cases of giardiasis should be considered for anti-parasitic treatment. The *Medical Letter*, recommends metronidazole as the drug of choice for treating giardiasis (32,33). The most commonly prescribed drug therapies are listed in Table 2.

Table 2. Anti-parasitic drug therapy for giardiasis.

DRUG	EFFICACY	COMMENTS
Metronidazole (Flagyl ®)	80-95%	Most frequently prescribed drug for giardiasis in the United States although not approved by Food and Drug Administration for treatment of giardiasis. Not recommended during pregnancy.
Furazolidone (Furoxone ®)	72-100%	More acceptable to children since it is the only drug available in liquid suspension. Not recommended during pregnancy
Quinacrine hydrochloride (Atabrine ®)	85-95%	No longer manufactured in the United States and the availability is extremely limited. Bitter taste may inhibit compliance and subsequent cure rates. Not recommended during pregnancy.
Albendazole	Unknown	Can be made into a suspension and given to children > 2 years old.
Paromomycin (Humatin ®)	50-70%	Poorly absorbed from the intestine. Can be used to treat symptomatic infection in pregnant women (10)

Physicians should follow current manufacturers recommendations on dosage, and refer to the Physicians Desk Reference for additional information on anti-parasitic drug therapy.

Note 10. There is no anti-parasitic medication that is 100% effective in treating giardiasis.

B. Treatment of Asymptomatic Cases of Giardiasis.

The decision whether or not to treat asymptomatic persons with giardiasis remains controversial. When considering treatment, a careful history may be required to distinguish truly asymptomatic persons from those infected persons with non-diarrheal illness who exhibit other symptoms of giardiasis (e.g. flatulence, foul smelling stool, nausea and abdominal pain) (32).

The Report of the Committee on Infectious Diseases, American Academy of Pediatrics (2000 Red Book) recommends that asymptomatic giardiasis should not be treated (20). While this general recommendation is widely accepted as standard of practice, it does not address special circumstances when treatment of asymptomatic children or those children with non-diarrheal giardiasis may be warranted (see Table 2).

Table 3. Indications for considering treatment of children with non-diarrheal or asymptomatic giardiasis (34) .

Individual Health Indications

Infected child does not have diarrhea but has one or more of the following conditions:
1. Nonspecific (persistent or intermittent) gastrointestinal symptoms
2. Evidence of malabsorption, impaired growth or failure to thrive
2. Otitis media with a history of repeated antibiotic treatment failures*

Public Health Indications

1. Outbreak control:
An asymptomatic infant or toddler attends a daycare center in which other outbreak control measures have failed to reduce the number of cases of giardiasis, especially if the asymptomatic person is in the same room or play group with others who have giardiasis.

2. Prevention of household transmission:
An asymptomatic infant or toddler is diapered by one of the following persons:
a. a pregnant woman
b. a person who has hypogammaglobulinemia or cystic fibrosis
c. a person who has a history of intolerance to anti-giardia drugs
d. a person with a previous episode of severe giardiasis

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* Clinical data suggest that *Giardia* infection may contribute to treatment failures of certain infections (e.g. otitis media), by interfering with absorption of commonly prescribed antibiotics (31).

Note 11. In most cases, persons with asymptomatic giardiasis should not be treated.
Note 12. Individual circumstances may warrant treatment of asymptomatic giardiasis cases.

VII. MANAGEMENT AND FOLLOW-UP OF GIARDIASIS IN SPECIFIC SETTINGS

A. Sporadic Cases of Giardiasis

When an individual is diagnosed with giardiasis, contacts of the infected person should be monitored for gastrointestinal symptoms. Most cases of giardiasis are isolated and no transmission to contacts of the infected individual is noted. If none of the contacts are symptomatic, no further investigation is necessary. If contacts are symptomatic, these individuals should submit stool specimens to be screened for *Giardia* and other enteric pathogens. Individuals symptomatic with *Giardia* infection should be considered for treatment. Asymptomatic individuals who had contact with a known case do not need to be screened.

B. Giardiasis in Food Workers

Although *Giardia* is known to be transmitted through contaminated food, the contribution of foodborne transmission in giardiasis morbidity and incidence rates is not known (see Figure 3). If a symptomatic food worker has giardiasis, the individual should be considered for treatment. Food workers with acute diarrhea should be excluded from preparing and serving food until the diarrhea ceases. An asymptomatic food worker should be allowed to continue their assigned job while practicing good personal hygiene, and wearing gloves during salad and preparation of food especially food that will not be cooked.

C. Giardiasis in Health Care Workers

Health care workers who care for individuals infected with *Giardia* may be at risk of becoming infected or transmitting the infection to other patients/residents, although the extent of this risk has not been determined (see Figure 6). If *Giardia* infection is found in a symptomatic health care worker, the individual should be considered for treatment. Health care workers with acute diarrhea should be excluded from direct patient/resident care, and from preparing and serving food until they become asymptomatic. An asymptomatic health care worker should be allowed to continue their assigned job while practicing good personal hygiene, (35).

Note 13. Food workers with acute diarrhea should be excluded from food preparation until asymptomatic.
Note 14. Health care workers with acute diarrhea should be excluded from patient/resident care and from preparing and serving food until they become asymptomatic.

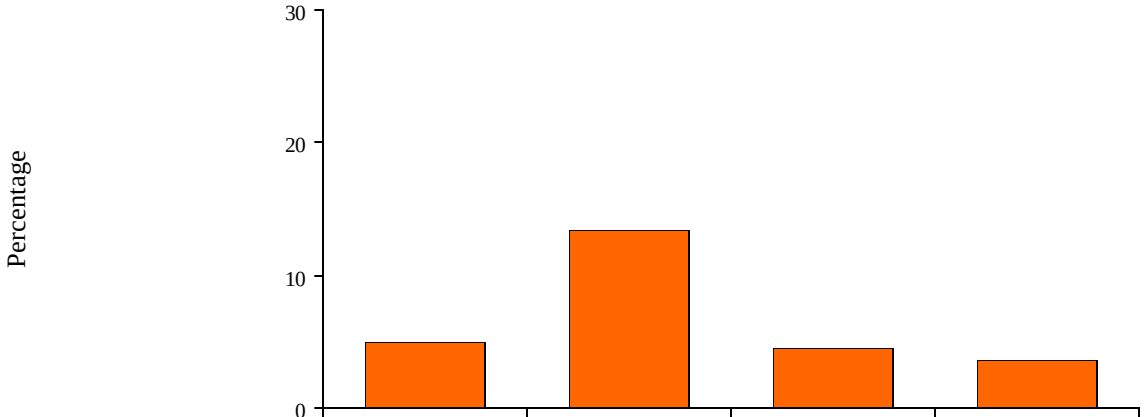
D. Giardiasis in Day Care Centers (DCC)

Between 1991-2000, approximately 13% of the reported cases of laboratory confirmed giardiasis attended or worked at a day care center. The CDC estimates the prevalence of *Giardia* in stool specimens may be as high as 35% among day care attendees (2). The risk of acquiring giardiasis following exposure at a day care center is 3-4 times higher than other risk groups.

1. Exclusion policies and control measures: Parents should be encouraged to keep children with acute diarrhea out of day care until they become asymptomatic. Asymptomatic children with giardiasis should not be excluded from day care. Day care workers should attempt to be aware of changes in every child's stool consistency, especially infants and toddlers. Day care workers with acute diarrhea should be excluded from work until asymptomatic. Asymptomatic day care workers should be allowed to continue their assigned job while practicing good personal hygiene and handwashing techniques, especially after handling items contaminated with feces (5,17).

2. Outbreak control: It is usually not necessary to screen asymptomatic individuals for *Giardia* after a sporadic case has been identified among children or staff at a day care center. If there is evidence that giardiasis has spread to other children, screening of asymptomatic children and staff for *Giardia* infection may be warranted. An algorithm has been developed to assist day care centers and local health departments with this process (see Appendix B).

Figure 5. Percentage of reported cases of giardiasis among identified risk group, Wisconsin, 1991-2000.



	None of the above	Staff/attendee of day care	Health care workers	Food handler
Percentage among risk groups	5	13.4	4.5	3.6

Note 15. Day care attendees and workers with giardiasis should be excluded until they become asymptomatic.

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Giardiasis

Disease Fact Sheet Series

What is giardiasis?

Giardiasis is an intestinal illness caused by a microscopic parasite called *Giardia lamblia*. It is a very commonly reported cause of diarrheal illness in Wisconsin with an average of 1200-1300 cases reported in Wisconsin each year. Cases may occur sporadically or in outbreaks.

Who gets giardiasis?

Anyone can get giardiasis but it tends to occur more often in people in institutional settings, people in day care centers, foreign travelers and individuals who consume improperly treated surface water (lakes, rivers, streams, etc).

How is this parasite spread?

The giardia parasite is passed in the feces (stool) of an infected person or animal and may contaminate water or food. It can also be spread by direct or indirect contact with fecal material from an infected person or animal. This may occur in day care centers or in settings where handwashing practices are poor.

What are the symptoms of giardiasis?

Many people with giardiasis do not experience any symptoms. Those who become ill have symptoms that include mild to severe diarrhea, increased flatulence, abdominal cramps, weight loss and bloating. Fever is rarely present.

How soon do symptoms appear?

The symptoms may appear from 3 to 25 days after exposure but usually within 7-10 days.

How long can an infected person carry Giardia?

The carrier stage generally lasts from a few weeks to months. Treatment with specific antibiotics may shorten the carrier stage.

Should an infected person be excluded from work or school?

People with active diarrhea need to be excluded from settings where they may spread the illness such as school, day care centers or other group activities, until the diarrhea stops. In addition, some local health departments may require follow-up stool testing to confirm that the person can no longer spread the illness.

(Over)

What is the treatment for giardiasis?

Specific antibiotics are often prescribed by doctors to treat giardiasis. However, some individuals may recover on their own without medication.

What can a person or community do to prevent the spread of giardiasis?

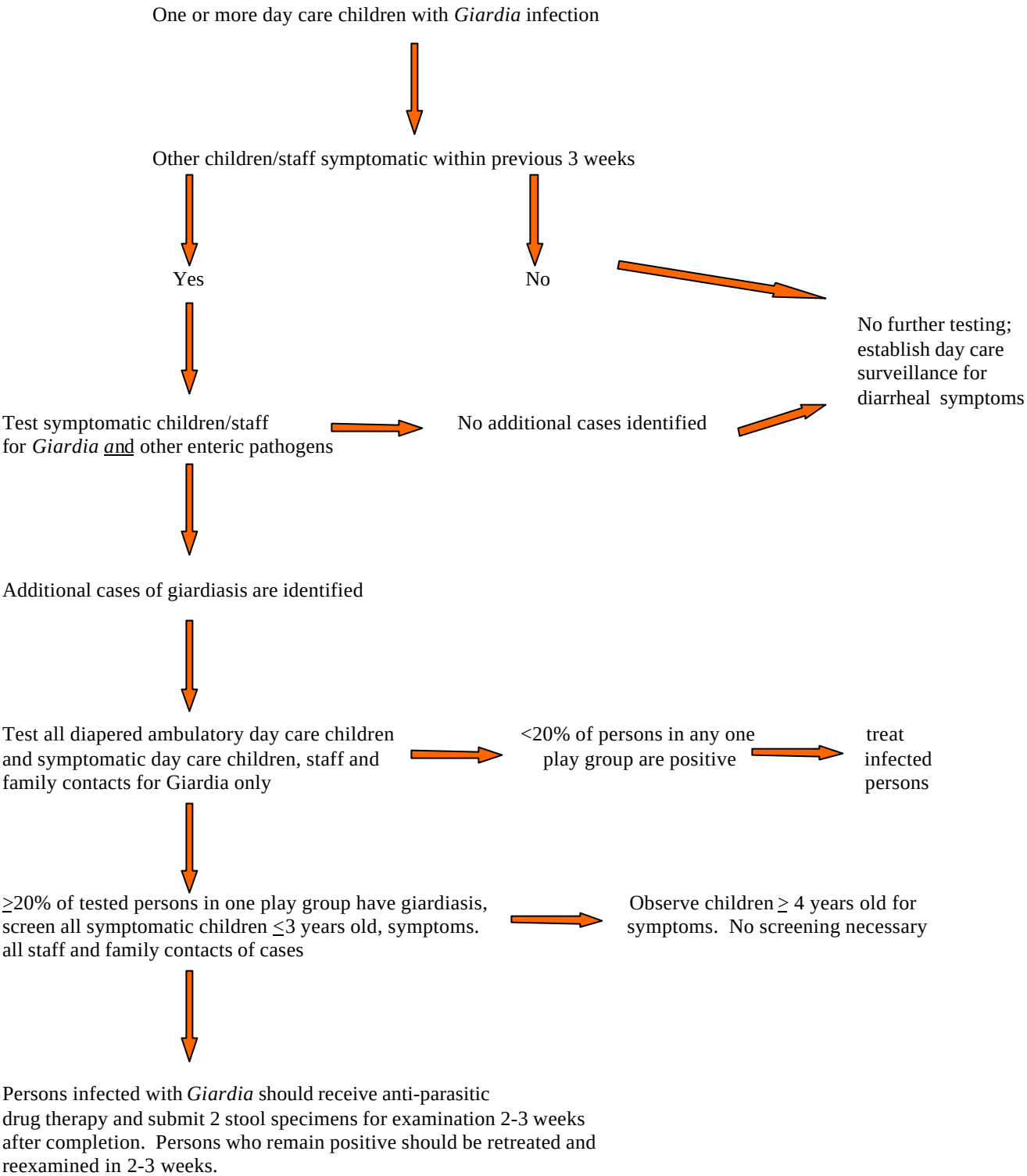
Three important preventive measures are:

- Wash hands thoroughly after toilet visits.
- Carefully dispose of sewage and disposable diaper wastes so as not to contaminate surface or groundwater.
- Avoid consuming improperly treated water. Emergency water supplies are best boiled or treated with hypochlorite or iodine (2 to 4 drops of household bleach or 0.5 ml of 2% tincture of iodine per quart for 20 minutes, or longer if the water is cold or turbid.)

DEVELOPED BY THE DIVISION OF PUBLIC HEALTH, BUREAU OF COMMUNICABLE DISEASES, COMMUNICABLE DISEASE EPIDEMIOLOGY SECTION.
6/01

Appendix B.

Algorithm for the investigation and control of giardiasis in a day care center



Appendix C.

A prototype letter to parents/family following a single case of giardiasis in a day care center.

Date _____

Dear Parent:

Recently, an individual in your child's day care center was diagnosed with *Giardia* infection.

The *Giardia* parasite is usually spread from person-to-person by the accidental consumption of feces from an infected person. Inadequate handwashing following bathroom use or changing diapers allows some organisms to remain on the hands and be easily be spread to others by hand-to-mouth contact. *Giardia* can also be spread by consuming water or food contaminated with feces from an infected person or animal.

Most individuals with *Giardia* infection show no clinical symptoms. When symptoms do occur, they may include abdominal cramps, increased flatulence, chronic or intermittent diarrhea, fatigue, loss of appetite, and weight loss.

If your child is experiencing any of these symptoms, please notify your personal physician to arrange to have a sample of your child's stool be collected and examined for the presence of the *Giardia* parasites. Because of the high rate of non-symptomatic individuals with *Giardia* infection, stool should also be tested for other causes of their illness.

Children with diarrhea will not be able to attend day care until they are free of symptoms. It is important that your child not be enrolled into another day care center while symptomatic, since this may promote the spread of infection.

Appendix D.

A prototype letter to parents/family during an outbreak of giardiasis at a day care center.

Date_____

Dear parent:

Several cases of Giardia infection have been identified among individuals in your child's day care center.

The *Giardia* parasite is usually spread from person-to-person by the accidental consumption of feces from an infected person. Inadequate handwashing following bathroom use or changing diapers allows some organisms to remain on the hands which can easily be spread to others by hand-to-mouth contact. *Giardia* can also be spread by consuming water or food contaminated with feces from an infected person or animal.

Most individuals with *Giardia* infection have show no clinical symptom . When symptoms do occur, they may include abdominal cramps, increased flatulence, chronic or intermittent diarrhea, fatigue, loss of appetite, and weight loss.

To prevent further spread of the infection within the day care center it is important to examine the stool of all children for the presence of the Giardia parasite. You will be supplied a stool collection kit from the local health department. The stool will be examined at the State Laboratory of Hygiene without charge to you. You will be notified of the results of your child's test.

Children with diarrhea will not be able to attend day care until they are free of symptoms. It is important that your child not be enrolled into another day care center while symptomatic, since this may promote the spread of infection

If you have any questions please contact the local health department or the day care center.

Appendix E.

CDC Recommendations for the Prevention and Control of Giardiasis (2)

***Practice good hygiene*.**

- Wash hands thoroughly with soap and water.
    - Wash hands after using the toilet and before handling food (especially for persons with diarrhea).
    - Wash hands after every diaper change and when working with children, even if you are wearing gloves.
- Avoid swimming if experiencing diarrhea (essential for children in diapers).

Avoid water that might be contaminated.

- Avoid swallowing recreational water (e.g., water in lakes, rivers, swimming pools, water parks).
- Avoid drinking untreated water from shallow wells, lakes, rivers, springs, ponds, and streams.
- Avoid drinking untreated water during community wide outbreaks caused by contaminated drinking water.
- Avoid drinking untreated water in countries where the water supply might be unsafe.
- If you are unable to avoid water that might be contaminated, then treat the water.
    - Heat water to a rolling boil for 1 minute. OR
      Use a filter that has an absolute pore size of at least 1µm or that has been NSF-rated for cyst removal.
    - Do not rely on cyst inactivation by chlorination or iodination, which are less effective than other methods because they are highly dependent on the temperature, pH, and cloudiness of the water.

Avoid food that might be contaminated.

- Use uncontaminated water to wash all food that is to be eaten raw.
- Avoid eating uncooked foods when traveling in disease-endemic areas.

***Avoid fecal exposure during sex*.**

Appendix F.

Technical Notes on Giardiasis in Wisconsin

Incidence

Note 1. Since 1991, The incidence rate and number of reported cases of giardiasis has declined. .
Note 2. Children < 5 years old have the highest incidence of giardiasis.
Note 3. The incidence of giardiasis peaks in late summer/early autumn.

Clinical Disease

Note 4. Children and persons with prior episodes are most likely to have asymptomatic giardiasis
Note 5. Two distinct clinical spectrums of giardiasis are seen among infected individuals.

Epidemiology and Prevention

Note 6. Concentrations of chlorine used in drinking water treatment do not kill *Giardia* cysts.
Note 7. Day care attendees and those who ingest untreated water are at high risk of acquiring giardiasis.
Note 8. Handwashing is the most effective measure to prevent transmission of giardiasis.

Laboratory Diagnoses

Note 9. To assure a reliable diagnosis, consider collecting up to three specimens from symptomatic persons, on consecutive days or every other day for five days.

Treatment

Note 10. There is no anti-parasitic medication that is 100% effective in treating giardiasis.
Note 11. In most cases, persons with asymptomatic giardiasis should not be treated.
Note 12. Individual circumstances may warrant treatment of asymptomatic giardiasis

Management in Specific Settings

Note 13. Food workers with acute diarrhea should be excluded from food preparation until they are asymptomatic.
Note 14. Health care workers with acute diarrhea should be excluded from patient/resident care and from preparing and serving food until they become asymptomatic.
Note 15. Day care attendees and workers should be excluded until they become asymptomatic.